International portfolio diversification: currency, industry and country effects revisited

Esther Eiling
University of Toronto

Bruno Gerard
BI Norwegian Business School

Pierre Hillion
INSEAD

Frans A. de Roon
Tilburg University

International Portfolio Diversification: Currency, Industry and Country Effects Revisited

Esther Eiling[1] [2]

University of Toronto, Rotman School of Management

Bruno Gerard

Norwegian School of Management and Tilburg University

Pierre Hillion

INSEAD and CEPR

Frans de Roon

Tilburg University, CentER and Netspar

This version: December 2009

[1]Corresponding author: Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, Ontario M5S 3E6, tel:+1-416-946-3121, email: Esther.Eiling@Rotman.Utoronto.Ca.

International Portfolio Diversification: Currency, Industry and Country Effects Revisited

Abstract

We examine the relative importance of country, industry, world market and currency risk factors for international stock returns. Our approach focuses on testing the mean-variance efficiency of the various factor portfolios. An unconditional analysis does not detect significant differences between country, industry and world portfolios, nor any role for currency risk factors. However, when we allow expected returns, volatilities and correlations to vary over time, we find that equity returns are mainly driven by global industry and currency risk factors. We propose a novel test to evaluate the relative benefits of alternative investment strategies and find that including currencies is critical to take full advantage of the diversification benefits afforded by international markets.

1 Introduction

One of the core questions in international finance is which factors drive international equity returns. A substantial amount of research focuses on the comparison of country versus industry factors. This was first investigated by Lessard (1974). Renewed attention to the issue and a voluminous literature was sparked by the work of Roll (1992), Heston and Rouwenhorst (1994) and Griffin and Karolyi (1998). Today, more than three decades later, the country-industry debate is still ongoing.[3]

A closely related issue is financial market integration. In fully integrated markets, only global risks are priced (e.g. Solnik, 1974a; Sercu, 1980; Adler and Dumas, 1983) while in segmented markets only local risks are priced.[4] Several recent papers provide evidence that national equity markets are becoming more integrated within the world market (e.g. De Jong and De Roon, 2005; Carrieri et al., 2007; Pukthuanthong-Le and Roll, 2008). This suggests that international equity returns are increasingly driven by global rather than by local factors.

Further, currency risk factors could play an important role for global stock returns. Several international asset pricing models show that, in equilibrium, when currency risk induces deviations from purchasing power parity, investors require to be compensated for bearing exchange rate risk (e.g. Stulz, 1981). Dumas and Solnik (1995), De Santis and Gerard (1998) and Lustig and Verdelhan (2007) report empirical evidence of a premium for currency risk.[5]

---

[3]Traditionally, country factors are found to dominate industry factors (amongst others, Grinold, Rudd and Stefek, 1989; Drummen and Zimmerman, 1992; Heston and Rouwenhorst, 1994; Griffin and Karolyi, 1998; Brooks and Del Negro, 2005; Ehling and Ramos; 2006, Campa and Fernandes, 2006; Catão and Timmermann, 2007; Bekaert, Hodrick and Zhang, 2008). However, several more recent papers show that industry factors becoming increasingly important (e.g. Cavaglia, Brightman and Aked, 2000; Isakov and Sonney, 2004; Baele and Inghelbrecht, 2005; Hardouvelis, Malliaropulos, and Priestley, 2007). Ferreira and Gama (2005) report an increase in industry volatility, while country volatility has remained relatively stable.

[4]e.g. Stulz (1981), Errunza and Losq (1985), Bekaert and Harvey (1995) - for a survey, see Stulz (1995).

[5]See also Vassalou (2000), De Santis, Gerard and Hillion (2003), Dahlquist and Sällström (2002), Chang, Errunza, Hogan and Hung (2005) and Zhang (2006).

This paper investigates to what extent international stock returns are driven by country, industry and currency risk factors. In addition, we consider as benchmark models the world Capital Asset Pricing Model that includes the world market return and the International CAPM that includes and several currency returns as well. A common approach for comparing country and industry effects is based on a factor model with country and industry dummy variables (Heston and Rouwenhorst, 1994; Griffin and Karolyi, 1998). This model assumes a unit exposure to the global market shock for all assets, which may lead to biases in comparing country and industry factors (Baele and Inghelbrecht, 2007; Bekaert et al. 2008).

We propose an alternative approach and a novel test to provide new insights into the role of currency, country and industry factors in driving equity returns in the seven largest world economies over the 1975 to 2005 period. We proceed in two steps. First, we conduct spanning tests to investigate whether a subsets of the portfolios or factors under consideration is mean-variance efficient when tested against the remainder of the assets. If for instance, the Adler and Dumas (1983) version of the international CAPM is the appropriate model to describe equilibrium returns in international markets, the world and currency factor portfolios would span all other asset returns. In a second step we propose a new test to investigate the relative benefits of alternative international diversification strategies based on country, global industry and currency factor portfolios. We perform all our tests both unconditionally and conditionally, as well as both unconstrained and with reasonable limits on short sales.

Our unconditional tests do not detect significant differences between country, industry and world portfolios. Spanning is only marginally rejected for the world portfolio with respect to global industry returns, suggesting that the world portfolio may not have optimal industry weights. Moreover, the unconditional analysis provides no evidence that currency risk factors matter; currency returns are spanned by country, industry and world market portfolio returns.

In contrast, when we allow for time-varying means and (co)variances using returns on managed portfolios, we can identify which factors dominate. Our conditional results show

that international equity returns are primarily driven by industry and currency risk factors. While country returns are spanned by global industry returns, industry returns are not spanned by country returns. This corresponds to a tangency portfolio that is linear in the returns on industry portfolios. Furthermore, similar to the unconditional results the world market portfolio is efficient with respect to country returns, but not with respect to global industry returns. The dominance of global industry factors over country factors is in line with the seven developed countries in our sample being among the most integrated equity markets in the world. Finally, we find that currency returns significantly improve the mean-variance efficiency of country, industry and world market portfolio returns.

These findings have important implications for cross-border investment strategies. Using our new test, we find that passive country- and industry-based equity strategies deliver indistinguishable Sharpe ratios. When portfolios are rebalanced every month, industry-based strategies lead to significantly higher Sharpe ratios. However, this outperformance critically depends on the ability to take short positions. Further, while including currencies in passive strategies does not deliver significant benefits, in actively rebalanced portfolios currencies are essential for achieving optimal portfolio performance. Strikingly, adding currency deposits to long-only managed country or industry portfolios doubles their annual Sharpe ratios. Cross-border investors take implicit currency positions and investing in currency deposits may hedge against currency risk (e.g. Campbell et al., 2008). At the same time, currency deposits can also be attractive investments themselves, due to their non-zero expected returns.[6] We allow for both hedging and speculative benefits by jointly optimizing over international equities and currency deposits. Whether hedging or speculative benefits are more important is left for future research.

The paper proceeds as follows. Section 2 develops the empirical framework, introduces our new test and shows the link with spanning tests. Section 3 describes the data. Section 4

---

[6]In practice, a popular currency speculative strategy is the carry trade, which has historically often delivered a very attractive risk-return trade-off (e.g. Burnside et al., 2007).

reports our unconditional results, while Section 5 discusses the conditional analysis. Section 6 concludes. The appendix shows the derivation of some econometric results.

2 Empirical framework

We use mean variance analysis to investigate the relative importance of country, industry, world market and currency risk factors. When examining which factors drive international equity returns, financial market integration plays an important role. In fully segmented markets only local risks are priced. In contrast, in perfectly integrated markets with no barriers to international investments, all investors face the same investment opportunity set and only global risks are priced. Therefore, in addition to country factors and global industry factors we consider two additional well-known asset pricing models.

The world CAPM is a single factor model that includes the world stock market portfolio. This model holds when assuming fully integrated markets where investors have the same consumption opportunity sets (see e.g. Stehle, 1977). However, when consumption opportunity sets differ or when purchasing power parity is violated, Solnik (1974a), Secru (1980) and Adler and Dumas (1983) show that foreign exchange rate risk is priced. The resulting international capital asset pricing model (ICAPM) includes the world portfolio and a number of foreign currency deposits.

2.1 Spanning tests

Suppose that only industry factors are priced in international equity returns. This implies that with exact factor pricing, a linear combination of the industry factor portfolios is mean-variance efficient.[7] We can test whether the tangency portfolio is a linear combination of the

---

[7]Studies of classical efficiency tests are, amongst others, Gibbons (1982), Jobson and Korkie (1982), Stambaugh (1982), Gibbons, Ross and Shanken (1989).

industry portfolios using the following regression:

$$r_t^x = a_x + B_x r_t^y + \varepsilon_t^x \tag{1}$$

where r_t^y is a vector of excess returns on N industry portfolios. In this example we consider excess returns on L country portfolios (r_t^x) as test assets, but in principle the dependent variables are all primary assets in the economy. If there is exact factor pricing with respect to the N industry factors, all elements of the intercept a_x should be zero. The intercept is also known as the Jensen measure. Testing whether the Jensen measure equals zero is the usual mean-variance spanning test (e.g., Huberman and Kandel, 1987; DeRoon, Nijman, and Werker, 2001). Under the null hypothesis, industry returns span country returns. If the Jensen measure is different from zero, mean-variance efficiency can be improved by adding country portfolios (i.e. the test assets) to the set of industry portfolios (i.e. the benchmark assets). Since the country and industry portfolios have components in common, this implies that a significant Jensen measure a_x requires changing the country weights in the global industry portfolios. Consequently, a model in which international equity returns are only driven by global industry factors would be rejected.

Similarly, if the ICAPM holds, the tangency portfolio is a linear combination of the world equity portfolio and the currency deposits. When regressing country or industry returns on the world market return and several currency deposit returns, the intercept should be zero. In sum, we examine which factors drive international equity returns by analyzing the mean-variance efficiency of these alternative sets of factors.

2.2   Sharpe ratio tests

This research has clear implications for investors as well. If the tangency portfolio is not a linear combination of industry factor portfolios, an industry-based international diversification strategy would be suboptimal. This section proposes a test that allows us to directly compare the mean-variance optimality of various international diversification strategies. We

compare diversifying across countries or global industries. Also, we consider adding currency deposits and investing in the world market portfolio. Indeed, if the ICAPM is a valid pricing model, then neither industry- nor country-based portfolios should be able to outperform portfolios strategies based on the world portfolio and foreign currency deposits.

When comparing diversifying across N global industries to diversifying across L countries, we are basically comparing two constrained strategies. In principle, investors can optimize over the full set of $L \times N$ local industry returns in all countries. However, it is often practically infeasible to optimize over all local industries in all countries. Instead, most individual investors would invest in country (or regional) mutual funds and global industry mutual funds.[8] In addition, while optimally diversifying over all $L \times N$ local industry returns may lead to a better in-sample portfolio performance, in practice, it is much more challenging to estimate the out-of sample weights, as this involves the estimation of a very large covariance matrix.

For ease of exposition, in the next discussion we compare country- versus industry-based strategies. We start with the usual spanning regressions:

$$
\begin{aligned}
r_t^y &= a_y + B_y r_t^x + \varepsilon_t^y, & \text{(2a)} \\
r_t^x &= a_x + B_x r_t^y + \varepsilon_t^x, & \text{(2b)}
\end{aligned}
$$

To directly compare the mean-variance efficiency of country- and industry- only portfolios, we compare their maximum Sharpe ratios. The maximum Sharpe ratios of country returns will be denoted θ_x and of industry returns is denoted θ_y, whereas the maximum Sharpe ratio of the combined set is θ. It is well known that there is a straightforward relationship between the maximum Sharpe ratios θ_x, θ_y, and θ and the Jensen regressions (2) (see Gibbons, Ross and Shanken, 1989). The increase in the maximum Sharpe ratios is determined by the

---

[8]Another alternative is international style investing, such as growth or value strategies.

7

adjusted Jensen measures, using:

$$\theta^2 - \theta_x^2 = a_y' \Omega_{yy}^{-1} a_y, \tag{3a}$$

$$\theta^2 - \theta_y^2 = a_x' \Omega_{xx}^{-1} a_x, \tag{3b}$$

where Ω_{ii} is the covariance matrix of ε_t^i in (2). The hypothesis of interest is whether θ_x equals θ_y. Taking the difference of (3a) and (3b) gives

$$\lambda = \theta_y^2 - \theta_x^2 = a_y' \Omega_{yy}^{-1} a_y - a_x' \Omega_{xx}^{-1} a_x. \tag{4}$$

Therefore, the hypothesis that the two sets x and y are equally efficient can be formulated as $H_0 : \lambda = 0$.

A test for the hypothesis that λ equals zero can be based on the weighted least squares type regressions

$$\Omega_{yy}^{-\frac{1}{2}} r_t^y = c_y + D_y r_t^x + u_t^y, \tag{5a}$$

$$\Omega_{xx}^{-\frac{1}{2}} r_t^x = c_x + D_x r_t^y + u_t^x. \tag{5b}$$

Since this regression amounts to a simple linear transformation of the dependent variables in the regressions in (2) it follows immediately that

$$c_y = \Omega_{yy}^{-\frac{1}{2}} a_y,$$

$$c_x = \Omega_{xx}^{-\frac{1}{2}} a_x,$$

and therefore that

$$\lambda = c_y' c_y - c_x' c_x. \tag{6}$$

Thus, the hypothesis that the two sets of assets, x and y are equally efficient can be tested by estimating the regression in (5) and testing the hypothesis that $c_y' c_y - c_x' c_x = 0$. Since this is a single nonlinear restriction on the intercepts, a Wald test statistic for this restriction will, under the null-hypothesis and standard regularity conditions, asymptotically be χ_1^2-distributed. Of course, in practice the test will require a two-step estimation, where in the

first step we estimate the regression in (2). This estimation will yield consistent estimates of the covariance matrices Ω_{xx} and Ω_{yy} which in the second step can be used to estimate the transformed regression in (5). Naturally, this implies that we will have estimation error in the dependent variables in (5). Further since both country and global industry portfolios include some common primitive assets, the estimation errors are correlated. Appendix A describes how consistent estimates of the covariance matrix of the parameters c and D can be obtained, taking into account both the estimation error in $\widehat{\Omega}_{xx}$ and in $\widehat{\Omega}_{yy}$ and their correlation.

Our test is related to the test proposed by Basak, Jagannathan and Sun (2002). Their approach allows for the comparison of the efficiency of the optimal portfolio of countries (industries) with respect to a possibly suboptimal industry (country) portfolio that is constrained to have the same mean return. However, this restriction is not necessarily satisfied. In contrast, our test allows the researcher to make a direct comparison between two optimal portfolios. Further advantages are that short sales constraints and conditioning information can easily be incorporated.[9]

3   Data

We focus on the seven major developed stock markets around the world: the US, Canada, the UK, Japan, Germany, Italy and France. In terms of market values, together these markets form the dominant part of the world stock market. For the G7 countries, detailed monthly data on local industries, currencies and interest rates are available for our sample period that runs from February 1975 to February 2005 (i.e. 361 monthly observations). For each of the

---

[9]The spanning tests and the Sharpe ratio tests are clearly related, as can be seen from equation (4). Whereas in certain cases one can infer the difference in Sharpe ratios (λ) based on the spanning tests alone, in many other cases this is not possible. For example, when country returns are not spanned by industry returns and industry returns are not spanned by country returns either, we cannot make any inferences on the outcome of the Sharpe ratio test, as $\theta > \theta_y$ and $\theta > \theta_x$.

seven countries, we download ten local (level 3) industry indices, provided by Datastream. We consider monthly US dollar based returns with dividends reinvested. We construct global value-weighted industry returns from the local industry indices of the G7 countries. Also, we construct a value-weighted world market index composed only of the G7 country indices. Hence in this case, the geographical span of the global industry portfolios is exactly identical to that of the country and world indices. We construct forward currency returns from the exchange rates and one-month Eurocurrency rates.

Summary statistics of the returns for the seven countries, ten global industries and seven currency deposits are reported in Table 1. The table shows that the country indices have somewhat higher mean returns than the global industry indices, but the standard deviations appear to be higher as well. The p-values for the Wald test statistics that the mean returns are equal to zero show that this hypothesis is easily rejected for both the countries and the industries. The hypothesis that the mean returns are equal cannot be rejected for either the countries or the industries or the combined set. Therefore, according to those tests, the cross-sectional variation in the mean returns is not very high, neither within the sets of countries and industries nor between the two sets. For the currency deposits, the Canadian Dollar and the German Mark have noticeably lower mean returns than the other currencies. The Pound Sterling has the highest average return.

Next we examine the average correlations of each country, industry and currency with the set of countries, industries and currencies respectively. Thus, the fourth column shows the average correlation of each individual index with the seven country indices (excluding the correlation with itself). Similarly, the fifth and sixth columns show the average correlation of each individual index with the ten industry portfolios and with the currency deposits. As our sample contains three Euro-zone countries, we use the Japanese Yen, the Pound Sterling, the Canadian Dollar and the spliced series of the German Mark up to January 1999 and the Euro thereafter to compute the correlation with the currencies. The table shows that over the full sample period, the average correlation between the country returns is noticeably lower than

10

the average correlation between the industry returns, while the difference in mean returns between countries and industries is small. This suggests that differences between countries are more pronounced than differences between industries. Lastly, the correlations between currency forward returns and country or industry returns are of similar magnitude and they are typically less than half the average correlation between country and/or industry returns.

4   Which factors drive international equity returns?

We examine the relative importance of country, industry, world portfolio and currency risk factors for international equity returns by examining whether the tangency portfolio is a linear combination of these factors. Also, we analyze the implications for international diversification strategies. This section discusses unconditional tests over the full sample period and as a robustness check, we consider three nonoverlapping ten-year sub sample periods. In Section 5 we allow for predictable variation in expected returns, volatilities and correlations by using lagged instruments.

Our specification of the world CAPM uses the value-weighted portfolio of the G7 countries as the world portfolio. In the ICAPM we consider next to the world portfolio three currency deposits: the British Pound, the Japanese Yen and the spliced series of the Deutschemark (up to January 1999) and the Euro (thereafter). The Canadian Dollar is excluded because of its high correlation with the US Dollar. Similarly, because of the fact that the Deutschemark, the French Franc, and the Italian Lira are all highly correlated and stem from Euro-zone countries, we only use one of those currencies in our ICAPM (see also De Santis, Gerard, and Hillion, 2003).

4.1   Spanning test results

We first analyze to what extent international equity returns are affected by country or by industry factors, which is how the country-industry debate originally emerged in the

literature. Table 2 reports the results. Panel A reports the individual Jensen measures. On the left hand side, we test whether country portfolio returns are mean-variance efficient. A sufficient condition is that all individual Jensen measures are equal to zero. Indeed, we find that none of them are statistically significant. However, when using industry portfolios as the benchmark assets, we do not find any significant Jensen measures either. Panel B reports the p-values of the joint test of the significance of all Jensen measures, i.e. the spanning tests. Indeed, we cannot reject the null hypothesis that the tangency portfolio is a linear combination of the country returns, but we cannot reject the null hypothesis that it is a linear combination of the industry returns either.

Next, we consider two alternative international asset pricing models; the world CAPM and the ICAPM. Panel B shows that the world stock market portfolio is efficient with respect to the country returns (i.e. spanning cannot be rejected). However, spanning can be marginally rejected for the global industry returns, suggesting that the G7 market index does not have the optimal industry weights. Similar conclusions hold for the ICAPM. Adding currencies to country, industry or world portfolios does not significantly improve mean-variance efficiency.

In these spanning tests, the benchmark assets have primitive assets in common with the test assets, except for the currency deposits. In Panel C we perform alternative spanning tests where overlapping primitive assets are removed from the benchmark returns. Hence, when we regress for instance Canada on the global industry indices, none of the global industry indices will include Canadian stocks. By excluding a certain country from a set of industry benchmark portfolios one can investigate whether that country is a missing factor. Denoting the return of country i excluding industry j as $r_{i,t}^{x\backslash j}$ and the return of industry j

12

excluding country i as $r_{j,t}^{y \backslash i}$, our tests are now based on the following regressions:

$$r_{j,t}^y = a_j + \sum_{i=1}^{L} b_{ij} r_{i,t}^{x \backslash j} + \varepsilon_{j,t}^y, \qquad (7a)$$

$$r_{i,t}^x = a_i + \sum_{j=1}^{N} b_{ji} r_{j,t}^{y \backslash i} + \varepsilon_{i,t}^x, \qquad (7b)$$

where L is the number of countries and N is the number of industries. When the world portfolio is (part of) the benchmark, the country or industry test asset is excluded from the world portfolio. All our recomputed indices are value-weighted across their remaining components. Notice that the joint test of the Jensen measures is not a spanning test in the traditional sense, since the benchmark assets are different in each regression. The results in Panel C confirm our earlier findings: country returns are spanned by industry returns, even when those industry benchmark portfolios exclude the country of interest. Also, when country portfolios exclude the industry of interest, mean-variance efficiency cannot be significantly improved by adding the industry returns. Similar to Panel B, we find that the world portfolio and the ICAPM portfolios are inefficient with respect to the global industries. When the world portfolio excludes the country of interest, spanning is marginally rejected, which is the main difference with respect to Panel B.

In sum, these unconditional spanning tests do not yet allow us conclude whether country or industry factors dominate. We find some evidence suggesting that the world market portfolio may not have optimal industry weights. In this unconditional setting, currency factors do not play an important role.

4.2 Implications for international diversification strategies

Suppose international equity returns would be driven only by country factors. This would imply that investors would be able to achieve better portfolio performance by diversifying across countries rather than diversifying along different dimensions. We examine the implications for investors by directly comparing alternative international portfolio strategies. We

13

evaluate the maximum Sharpe ratios of portfolios based on country returns, global industry returns and the world portfolio return. In addition, we add currency deposits to these three alternative investment strategies. We test the differences in Sharpe ratios using the test proposed in Section 2. Table 3 reports the results.

Panel A shows the maximum annualized Sharpe ratios and Panel B reports the p-values for the tests of the pairwise differences in the maximum Sharpe ratios between the six portfolios. The first row of Panel A shows that the maximum annualized Sharpe ratio for a portfolio constructed from the global industry indices is 0.76 whereas for the countries it is 0.61. Although this difference might be economically meaningful, the p-value for the Wald test of whether the difference in Sharpe ratios is zero is 0.334. Hence we cannot reject the hypothesis that the two Sharpe ratios are equal, which is consistent with the results of the spanning tests. Further, if we add currencies to both industry- and country-based portfolios, their Sharpe ratios increase only marginally to 0.62 and 0.79 respectively. The difference between these two Sharpe ratios is again insignificant: the p-value is 0.278. The ICAPM and world portfolios have lower Sharpe ratios, 0.49 and 0.44 respectively. These are significantly lower (at the 10% level) than the Sharpe ratio of the industry portfolios combined with the currencies. Also, consistent with the spanning tests, we find that the Sharpe ratio of the world portfolio is significantly lower than that of the global industry portfolios, at the 10% level.

The portfolios that yield these maximum Sharpe ratios can require short positions, which may not always be implementable in realistic investment settings. In addition, it is well known that the tangency portfolios computed on the basis of historical mean returns and covariances often yields extreme long and short positions (e.g. Jagannathan and Ma, 2003). Therefore, we estimate the maximum attainable Sharpe ratios when short selling is prohibited. The results are given on the second row of Panel A. The third row reports the p-values of the test of whether imposing the no short sale constraint leads to an efficiency loss, i.e., a significant decrease in the maximum Sharpe ratio. Note that for the world and ICAPM

14

portfolios the Sharpe ratios are unaffected by the short sales constraints, as currencies are not subject to these constraints and for the world portfolio they are not binding. For the other four portfolios, the maximum Sharpe ratios decrease when restricting to long positions only. Even though this is statistically insignificant for all four portfolios, it is economically meaningful, especially for the industry portfolio where the annual Sharpe ratio is lowered from 0.76 to 0.66. Panel C reports the p-values of the tests of differences in the Sharpe ratios when short sales are restricted. It confirms the results in Panel B: whenever the difference in the unrestricted Sharpe ratios is (marginally) significant, it is also (marginally) significant for the long-only Sharpe ratios. In other words, our results are robust for restrictions on short selling.

Summarizing, these unconditional tests suggest that there is not a material difference in portfolio performance when passive portfolios are constructed from either countries or industries. Also, including currency deposits is of little benefit to portfolio performance.

4.3   Robustness check: sub sample analysis

Our analysis so far assumes that expected returns, volatilities and correlations and our estimated portfolio weights are constant over the full sample period. Before we perform a conditional analysis in the next section of the paper, we first examine three ten-year nonoverlapping sample periods: from February 1975 to January 1985, from February 1985 to January 1995 and from February 1995 to February 2005. The results can be found in Table 4.

Panel A reports the p-values of the spanning tests. In all three sub sample periods, we find that country and industry portfolios are equally mean-variance efficient: countries span industries and vice versa. In contrast to the full sample results, we now find that the country or global industry portfolios are not mean-variance efficient with respect to the ICAPM portfolios in each of the three sub sample periods. Also, in the sample period from 1975 to 1985, currency deposit returns are not spanned by the country, industry or

world portfolios (spanning is rejected at the 10% significance level). This is a first indication that currencies may play a more important role when expected returns and (co)variances are allowed to change over time. Finally, we find that the world portfolio and the ICAPM portfolios are not mean-variance efficient with respect to the country or industry returns during the second sub sample periods. During the last ten-year sample period the world and ICAPM portfolios do not span country returns, while spanning cannot be rejected with respect to the industry returns.

Panel B reports the maximum Sharpe ratios, with and without short selling. Unreported results show that the difference in Sharpe ratios between country- and industry-based portfolios is insignificant in all three sub sample periods, with and without restrictions on short selling. When currency deposit returns are added to country or industry returns, these portfolios have significantly higher Sharpe ratios than the world portfolio.

In sum, we do not find significant differences in terms of mean-variance efficiency for country- or global industry-based diversification strategies in any of our three ten-year sub sample periods. We report some initial results suggesting that currency returns could be important for achieving mean-variance optimality, especially in the first sub sample period.

5 Conditional tests

A large body of evidence documents not only predictable variations in asset expected returns as market and economic conditions change, but also significant time variation in asset volatilities and correlations. In particular, Dumas and Solnik (1995) and De Santis and Gerard (1998) argue that the impact of currency risk on equity returns varies considerably over time and may be difficult to detect in an unconditional framework. Hence, we expand our analysis to consider strategies conditioned on a subset of the information that investors can use to manage their portfolios.

Conditional tests of mean-variance efficiency are based on an extension of unconditional

efficiency tests (Hansen and Richard, 1987). Assume that K instruments z_t can be used to predict asset returns. It is assumed that the instruments in z_t are normalized such that

$$0 \leq z_{k,t} \leq 1, \qquad \forall k, t.$$

One way to normalize the instrument is to consider the transformation

$$\Phi\left(\frac{z_t - m_z}{s_z}\right),$$

where m_z is the mean of z_t, s_z is the standard deviation of z_t, and $\Phi(\cdot)$ is the cumulative normal distribution function. Since the tests described above rely on the use of excess returns, the return space can be increased by multiplying the excess returns with the lagged instruments (see e.g. Shanken, 1990). This corresponds to a portfolio strategy where the weights are linear functions of the instruments.[10] We use returns on managed portfolios $z_{k,t-1}r_{i,t}$, where $z_{k,t-1}$ is the value an instrument takes at time $t-1$. The managed portfolio strategy implies that each period a position with a size $z_{k,t-1}$ in asset i is chosen. Next to the returns on the managed portfolios, we also include the returns on the country, industry and ICAPM portfolios themselves. In this way we get a total of $(K+1) \times M$ assets, where M is the number of country, industry, world, or ICAPM portfolios.

$$\{r_{i,t} , \ z_{k,t-1}r_{i,t} , i = 1, ..., M \text{ and } k = 1, ..., K.\}$$

For this set of assets we calculate the optimal (tangency) portfolio weights. Denote $\omega_{i,0}$ the weight of asset with return $r_{i,t}$ in the tangency portfolio and $\omega_{i,k}$ the weight of managed return $z_{k,t-1}r_{i,t}$. The total position in asset i at time t is now equal to

$$w_{i,t} = \omega_{i,0} + \sum_{k=1}^{K} \omega_{i,k}z_{k,t-1}. \tag{8}$$

---

[10]Ferson and Siegel (2009) investigate portfolio efficiency when portfolio weights depend optimally (and not necessarily linearly) on lagged instruments. While we focus on the traditional "multiplicative" approach, this could be an interesting direction for future research.

When examining the Sharpe ratios of various conditional portfolio strategies, we also incorporate short sales constraints. This requires additional steps to guarantee positive aggregate weights of the assets in the tangency portfolio. Since we normalized the instruments to take values between zero and one only, the maximum value of $z_{k,t}$ is always one, and positivity of the net position in asset i is guaranteed if

$$
\begin{aligned}
\omega_{i,0} &\geq 0, &&&(9)\\
\omega_{i,0} + \omega_{i,k} &\geq 0, && k = 1, ..., K\\
\omega_{i,0} + \omega_{i,k} + \omega_{i,l} &\geq 0, && k, l = 1, ..., K, l \neq k\\
&\vdots\\
\omega_{i,0} + \sum_{k=1}^{K} \omega_{i,k} &\geq 0.
\end{aligned}
$$

This implies a total of 2^K positivity constraints per asset. If $\omega_{i,0}$ plus any combination of the $\omega_{i,k}$s is positive, then the total position in asset i will always be positive.

To describe the investor's information set, we use a set of variables similar to those used in previous research. Since the G7 countries are among the most integrated countries in the world, we use global or US-based instruments. The instruments for country and industry returns and the return on the world index are the short term US interest rate, the dividend price ratio on the world equity index in excess of the one-month Euro-US\$ rate, the US term premium and the US default premium, measured by the yield difference between Moody's BAA and AAA rated bonds. In order to predict changes in currency risk premiums we use the following instruments: the short term US interest rate and the spreads between the UK and US interest rate, the Japanese and US interest rate, and the German and US interest rate, which we refer to as interest rate differentials. All variables are used with a one–month lag relative to the return series.

5.1 Conditional spanning tests

Table 5 reports the results of the conditional spanning tests. Panel A reports the p-values of the spanning tests when some of the test and benchmark portfolios have primitive assets in common. There are two important differences compared to the unconditional results.

First, whereas in the unconditional analysis countries span industries and vice versa, we now find that country portfolios no longer span global industry portfolios, while industry returns span country returns. These results are in line with a tangency portfolio that is a linear combination of global industry returns. Also, similar to the unconditional results we find that the world and ICAPM portfolios fail to span global industry portfolios. This time, spanning is rejected at the 1% significance level. In contrast, the world and ICAPM portfolios are mean variance efficient with respect to the country portfolios. In Panel B we exclude overlapping components between test and benchmark assets and we find similar results as in Panel A.

Second, currency factors play an important role in the conditional analysis. We find that the mean-variance efficiency of the country, industry and world portfolios can be significantly improved when adding positions in currency deposits. Panel A shows that spanning can be rejected at the 1% levels.

In conclusion, when allowing for predictable variation in expected returns, volatilities and correlations, our results suggest that international equity returns are driven predominantly by global industry factors and currency risk factors.

5.2 Dynamic portfolio strategies

Next, we take the perspective of a cross-border investor and compare the performance of alternative dynamic international diversification strategies. Investors can rebalance their portfolios at a monthly frequency, based on the values of lagged information variables. The results are reported in Table 6. We find that for all portfolios, the maximum Sharpe ratios

of the dynamic strategies are substantially higher than the Sharpe ratios of the passive, unconditional strategies reported in Table 3. This is indicative of the value of information and frequent portfolio rebalancing in enhancing portfolio returns. The most dramatic increase takes place for the portfolio consisting of industries and currency deposits: the maximum annual unconstrained Sharpe ratio nearly triples from 0.79 to 2.25 when rebalancing the portfolio every month. Again, industries have a higher Sharpe ratio than countries (1.78 versus 1.20) and in contrast to the unconditional tests, the difference is now statistically significant at a 1% level, as is reported in Panel B. Furthermore, while in the unconditional analysis we do not find significant benefits from adding currency deposits to the investment set, we now document a striking improvement in the performance of managed portfolios when adding currencies. When currencies are added to country- or industry-based portfolios, the Sharpe ratio increases substantially in both cases. In the next section we further explore why this remarkable currency outperformance is only detected in a conditional framework with active rather than passive portfolio strategies. After adding currencies, industries also outperform countries. Thus, these results suggest that in the absence of short selling restrictions, dynamic industry portfolios are more attractive than dynamic country portfolios. While country-based and industry-based portfolio strategies have higher Sharpe ratios than the dynamic ICAPM portfolio, the differences are not statistically significant. They become significant when currencies are added to the dynamic country and industry portfolios.

The managed portfolios may not always be implementable due to possibly large short positions. Therefore, we now impose short sales constraints. As the total position in any asset depends on the instruments, we restrict the total weight functions to be strictly positive functions of the instruments by imposing the constraints given in (9). The currency deposits are not subject to short sales constraints. The second row of Panel B reports the Sharpe ratios of the long-only portfolios. After imposing short sales constraints the maximum annualized Sharpe ratio for the managed industry portfolios drops from 1.78 to 0.80. For the managed country portfolios, the decrease is from 1.20 to 0.70. In contrast to the uncondi-

20

tional analysis, the efficiency loss due to the short sales constraints is both economically and statistically significant. The same holds for the country and industry portfolios that also include currency deposits. Again, the world and ICAPM portfolios are unaffected by the constraints. These results indicate that the performance of dynamic global industry portfolios is the most affected by the constraints. Panel C shows that with short sales constraints, managed country portfolios and managed industry portfolios (with and without currencies) yield indistinguishable Sharpe ratios. Interestingly, when short selling is not allowed, the Sharpe ratio of the world portfolio is not significantly different from the Sharpe ratios of the country or industry portfolios. We can again detect a clear outperformance of portfolios that include managed currency returns. The dynamic ICAPM portfolio outperforms both dynamic country and dynamic industry portfolios. Also, we document a dramatic increase in Sharpe ratios when currency deposits are added to long-only managed country or industry portfolios. The annual industry Sharpe ratio nearly doubles from 0.80 to 1.55 when currencies are added. The country Sharpe ratio increases from 0.70 to 1.51.

In conclusion, as in the case of passive portfolio strategies, dynamic country and global industry based strategies yield similar performance when restrictions on short selling are imposed. We document an outperformance of managed global industry portfolios only when short positions are allowed. However, short positions, specially in global industry portfolios, may be prohibitively expensive, or even not be possible for most investors On the other hand, adding currencies to dynamic equity portfolios, whether industry, country or ICAPM based delivers large and statistically significant performance improvements.[11]

---

[11]The outperformance of dynamic portfolios including currencies is not likely to be driven by extreme positions in currencies. Over the full sample period the average total position in the three currency deposits is approximately 10%. The total position in currencies lies between -100% and +100% in nearly every month.

5.3   A further look at currencies

In contrast to the unconditional results in Section 4, our conditional results indicate that currency risk factors play an important role as determinants of international equity returns. We also find that the performance of dynamic international portfolio strategies can be improved significantly when adding foreign currency deposits.[12]

Why would investors optimally hold foreign currency deposits? If purchasing power parity is violated, international investors hold positions in foreign equity as well as in foreign currencies thereby being exposed to currency risk. If currency risk is not compensated for and cannot be fully diversified away, investors should fully hedge against foreign exchange rate risk. Campbell, Serfaty-de Medeiros and Viciera (2008) report gains from currency hedging in international stock and bond portfolios. On the other hand, Dumas and Solnik (1995), de Santis and Gerard (1998) and Lustig and Verdelhan (2007) report significant currency risk premiums. Indeed, most of the risk premium on currency deposits is a compensation for currency risk. Hence, in addition to hedging demand, investors may also have speculative demand for currency deposits in case of non-zero expected excess returns.

The outperformance of dynamic portfolio strategies that include positions in currency deposits could be due to time variation in the hedging properties of currencies, which is exploited by using instruments. Alternatively, it could be caused by predictability in time variation in the expected returns. We examine this informally by considering how the correlations between currency and equity returns and mean currency returns change over time. Figure 1 Panel A reports the average correlations between the country and industry returns and returns on the three currency deposits under consideration (Japanese Yen, British Pound and German Mark - Euro) for 60-month moving windows. The figure shows that these correlations vary substantially over time and they seem to display a downward trend. Whereas in the first part of the sample period (up to the mid 1980s) the average correlation is close

---

[12]Unreported results show that when performing the conditional analysis in the three 10-year sub samples, currency risk factors play a significant role in all three sub sample periods.

to 0.4, the correlation decreases remarkably and even becomes close to zero in the five-year windows ending in 2000. In recent years the correlation between equities and currencies has increased slightly to approximately 0.2. This figure suggests that the hedging properties of currencies could be time-varying.

Panel B of Figure 1 displays the average (excess) returns on currency deposits over 60-month moving windows. The figure shows that average currency returns are highly time varying and vary from -1% per month in five-year windows from 1980 to 1985 to +1% per month in windows from 1985 to 1990. At the end of the sample period the average returns are about 0.2% per month. In contrast, Table 1 shows that average currency returns are very close to zero when calculated over the full sample period. These findings imply that currency investing could result in speculative gains if investors actively rebalance their portfolios to take advantage of time-varying expected returns on currency deposits.

Although not reported here, we find that the R^2s of regressions of the returns on the instruments are higher for currency deposits than for equity returns. This suggests that the instruments have most predictive power for the currency deposit returns. In sum, exploiting the higher degree of predictability in the hedging properties and in the expected excess returns on currency deposits by using actively managed portfolios dramatically improves portfolio performance. Whether the improvement in portfolio performance is mainly due to hedging or speculative benefits from investing in currencies is left for future research.

6   Summary and conclusions

Although the benefits of international diversification arising from the relatively low level of correlations among national equity markets are now well documented (e.g. Solnik, 1974b; Elton and Gruber, 1992; De Santis and Gerard, 1997), the issue of which factors drive international equity returns remains controversial. This paper proposes a different approach and a new test to provide fresh insights into the country-industry debate that has been

ongoing in the international finance literature for over three decades. First, we test which set of factor portfolios is mean-variance efficient and span the others, countries, industries or world market and currency factors. Second, we rigorously examine and propose a new test to evaluate the efficiency gains and diversification benefits of different international portfolio strategies. We focus on the seven largest world economies between 1975 and 2005.

Our unconditional analysis does not allow us to infer whether country or industry factors dominate: country returns span industry returns and vice versa. Currency risk factors do not play an important role here.

However, when we allow for predictable time variation expected returns, volatilities and correlations using conditioning information, we can identify which factors are most important. Our conditional analysis shows that international equity returns are mainly driven by industry and currency risk factors. The dominance of global industry factors over country factors is in correspondence with a relatively high degree of market integration. We also find that the world market factor does not span global industry returns. While spanning is rejected only marginally in our unconditional tests, our conditional tests strongly reject mean-variance spanning. These results suggest that the world portfolio does not provide optimal exposure to global industry returns. A fruitful direction for future research is to explore which economic fundamentals can explain this result.

In a second stage, we analyze the implications of these findings for international diversification strategies. We find that actively rebalanced industry-based strategies outperform country-based strategies, but only if short selling is allowed. With short sales constraints or when using passive portfolio strategies, country- and industry-based diversification strategies deliver similar Sharpe ratios. Finally, we find that active currency investing adds substantial diversification and return enhancement benefits to cross-border portfolios. Whether this outperformance is due to the hedging or speculative benefits of currency positions is left for future research.

24

Appendix: Derivation of the Sharpe ratio test

For ease of exposition, consider the regression models

$$y_t = b'x_t + \varepsilon_t, \tag{A1a}$$

$$\Omega^{-\frac{1}{2}} y_t = B'x_t + u_t. \tag{A1b}$$

Here $\Omega = Var[\varepsilon_t]$. Notice that we can always rewrite our regressions in this way. In order to derive the limiting distribution of $\widehat{B}$, we need to take into account that expression (A1b) uses an estimated covariance matrix $\widehat{\Omega}$ rather than the true covariance matrix Ω.

Denoting $\widehat{y}_t = \widehat{\Omega}^{-\frac{1}{2}} y_t$, the OLS estimate of B is

$$\widehat{B} = \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t \widehat{y}_t' \right).$$

Defining $\eta_t = \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}} \right) y_t$, we get

$$\begin{aligned}
\widehat{B} &= \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t \left(x_t' B + u_t' + \eta_t' \right) \right) \\
&= B + \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t \left(u_t' + y_t' \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}} \right) \right) \right).
\end{aligned}$$

Since the last terms converge to zero, $\widehat{B}$ is a consistent estimator of B.

From the last equation we obtain

$$\sqrt{T} \left(\widehat{B} - B \right) = \tag{A2a}$$

$$\sqrt{T} \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t u_t' \right) + \sqrt{T} \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t y_t' \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}} \right) \right)$$

$$\sqrt{T} \left(\widehat{B} - B \right) = \sqrt{T} \left(\sum_t x_t x_t' \right)^{-1} \left(\sum_t x_t u_t' \right) + \widehat{\beta} \sqrt{T} \left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}} \right). \tag{A2b}$$

The first term in the limiting distribution is standard, the interest here is in the second term, which arises because we have to use the estimated covariance matrix $\widehat{\Omega}$.

A.1 The limiting distribution of $\widehat{\Omega}$

In a standard regression framework, the limiting distribution of $\widehat{\Omega}$ is

$$\sqrt{T}\left(vech\left(\widehat{\Omega}\right) - vech\left(\Omega\right)\right) \to N\left(0, V\right).$$

We want to derive an expression for the covariance matrix V.

Consider the simple example where Ω is 2×2:

$$\Omega = \left(\begin{array}{cc} \omega_{1,1} & \omega_{1,2} \\ \omega_{2,1} & \omega_{2,2} \end{array}\right),$$

in which case we need the limiting distribution of

$$\sqrt{T}\left(\begin{array}{c} \widehat{\omega}_{1,1} - \omega_{1,1} \\ \widehat{\omega}_{1,2} - \omega_{1,2} \\ \widehat{\omega}_{2,2} - \omega_{2,2} \end{array}\right) = \frac{1}{\sqrt{T}}\left(\begin{array}{c} \Sigma_t \varepsilon_{1,t}^2 - T\omega_{1,1} \\ \Sigma_t \varepsilon_{1,t}\varepsilon_{2,t} - T\omega_{1,2} \\ \Sigma_t \varepsilon_{2,t}^2 - T\omega_{2,2} \end{array}\right)$$

The elements of the limiting covariance matrix can be written as

$$\begin{aligned} Var[\varepsilon_{1,t}^2] &= E[\varepsilon_{1,t}^4] - \omega_{1,1}^2 \\ Var[\varepsilon_{1,t}\varepsilon_{2,t}] &= E[\varepsilon_{1,t}^2\varepsilon_{2,t}^2] - \omega_{1,2}^2 \\ Cov[\varepsilon_{1,t}^2, \varepsilon_{1,t}\varepsilon_{2,t}] &= E[\varepsilon_{1,t}^3\varepsilon_{2,t}] - \omega_{1,1}\omega_{1,2} \\ Cov[\varepsilon_{1,t}^2, \varepsilon_{2,t}^2] &= E[\varepsilon_{1,t}^2\varepsilon_{2,t}^2] - \omega_{1,1}\omega_{2,2}, \end{aligned}$$

$$\text{etc.}$$

Thus, the covariance matrix looks like

$$V = \left[\begin{array}{ccc} E[\varepsilon_{1,t}^4] - \omega_{1,1}^2 & E[\varepsilon_{1,t}^3\varepsilon_{2,t}] - \omega_{1,1}\omega_{1,2} & E[\varepsilon_{1,t}^2\varepsilon_{2,t}^2] - \omega_{1,1}\omega_{2,2} \\ E[\varepsilon_{1,t}^3\varepsilon_{2,t}] - \omega_{1,1}\omega_{1,2} & E[\varepsilon_{1,t}^2\varepsilon_{2,t}^2] - \omega_{1,2}^2 & E[\varepsilon_{1,t}\varepsilon_{2,t}^3] - \omega_{1,2}\omega_{2,2} \\ E[\varepsilon_{1,t}^2\varepsilon_{2,t}^2] - \omega_{1,1}\omega_{2,2} & E[\varepsilon_{1,t}\varepsilon_{2,t}^3] - \omega_{1,2}\omega_{2,2} & E[\varepsilon_{2,t}^4] - \omega_{2,2}^2 \end{array}\right].$$

In general, the element of V corresponding to the covariance between $\widehat{\omega}_{i,j}$ and $\widehat{\omega}_{l,m}$ is

$E[\varepsilon_{i,t}\varepsilon_{j,t}\varepsilon_{l,t}\varepsilon_{m,t}] - \omega_{i,j}\omega_{l,m}.$

A.2 The limiting distribution of $\sqrt{T}\left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right)$

We know that

$$\sqrt{T}\left(vech\left(\widehat{\Omega}\right) - vech\left(\Omega\right)\right) = \sqrt{T}vech\left(\frac{1}{T}\sum_t \varepsilon_t \varepsilon_t' - \Omega\right).$$

For later use we will need the limiting distribution of $vec\left(\widehat{\Omega}\right)$ rather than of $vech\left(\widehat{\Omega}\right)$, but this one is obtained immediately from the above. Notice that $vec\left(\widehat{\Omega}\right)$ will have a singular covariance matrix, but this is not a problem in our application. Using a linear expansion, for the limiting distribution of $\sqrt{T}\left(\widehat{\Omega}^{-\frac{1}{2}} - \Omega^{-\frac{1}{2}}\right)$ we need the differential of $\Omega^{-\frac{1}{2}}$ with respect to Ω.

Following Magnus and Neudecker (1988), start with the matrix function $F(X) = X^{\frac{1}{2}}$. Since $X^{\frac{1}{2}}X^{\frac{1}{2}} = X$ we get

$$\left(\mathbf{d}X^{\frac{1}{2}}\right)X^{\frac{1}{2}} + X^{\frac{1}{2}}\left(\mathbf{d}X\frac{1}{2}\right) = \mathbf{d}X, \Rightarrow$$

$$\left(X^{\frac{1}{2}} \otimes I_K\right)vec\left(\mathbf{d}X^{\frac{1}{2}}\right) + \left(I_K \otimes X^{\frac{1}{2}}\right)vec(\mathbf{d}X^{\frac{1}{2}}) = vec(\mathbf{d}X) \Leftrightarrow$$

$$\left[X^{\frac{1}{2}} \otimes I_K + I_K \otimes X^{\frac{1}{2}}\right]\mathbf{d}vec\left(X^{\frac{1}{2}}\right) = \mathbf{d}vec(X),$$

and therefore the differential of $X^{\frac{1}{2}}$ with respect to X is obtained from

$$\mathbf{d}vec\left(X^{\frac{1}{2}}\right) = \left(X^{\frac{1}{2}} \otimes I_K + I_K \otimes X^{\frac{1}{2}}\right)^{-1}\mathbf{d}vec(X). \tag{A3}$$

The interest here is not in $X^{\frac{1}{2}}$, but in $F(X) = X^{-\frac{1}{2}}$, for which we have

$$\mathbf{d}X^{-\frac{1}{2}} = -X^{-\frac{1}{2}}\left(\mathbf{d}X^{\frac{1}{2}}\right)X^{-\frac{1}{2}}.$$

Taking vec's gives

$$\mathbf{d}vec\left(X^{-\frac{1}{2}}\right) = \left(-X^{-\frac{1}{2}} \otimes X^{-\frac{1}{2}}\right)\mathbf{d}vec\left(X^{\frac{1}{2}}\right),$$

which can be combined with (A3) to obtain

$$\mathbf{d}vec\left(X^{-\frac{1}{2}}\right) = \left(-X^{-\frac{1}{2}} \otimes X^{-\frac{1}{2}}\right)\left(X^{\frac{1}{2}} \otimes I_K + I_K \otimes X^{\frac{1}{2}}\right)^{-1}\mathbf{d}vec(X). \tag{A4}$$

If ε_t is a N-vector, then define the $N^2 \times N^2$ matrix A as

$$A = \left(-\Omega^{-\frac{1}{2}} \otimes \Omega^{-\frac{1}{2}} \right) \left(\Omega^{\frac{1}{2}} \otimes I_N + I_N \otimes \Omega^{\frac{1}{2}} \right)^{-1}. \tag{A5}$$

The limiting distribution of $vec\left(\widehat{\Omega}^{-\frac{1}{2}} \right)$ is then obtained from

$$\sqrt{T} \left(vec\left(\widehat{\Omega}^{-\frac{1}{2}} \right) - vec\left(\Omega^{-\frac{1}{2}} \right) \right) = \sqrt{T} A \left(vec\left(\frac{1}{T} \sum_t \varepsilon_t \varepsilon_t' - \Omega \right) \right). \tag{A6}$$

A.3 The limiting distribution of $\sqrt{T}\left(\widehat{B} - B \right)$

We are now in a position to derive the limiting distribution of $\sqrt{T}\left(\widehat{B} - B \right)$. Taking vec's of (11), we obtain

$$\sqrt{T} \left(vec\left(\widehat{B} \right) - vec\left(B \right) \right)$$

$$= \left(I_N \otimes \left(\sum_t x_t x_t' \right)^{-1} \right) \sqrt{T} vec\left(\sum_t x_t u_t' \right) + \left(I_N \otimes \widehat{\beta} \right) \sqrt{T} \left(vec\left(\widehat{\Omega}^{-\frac{1}{2}} \right) - vec\left(\Omega \right) \right)$$

$$= \left(I_N \otimes \left(\sum_t x_t x_t' \right)^{-1} \right) \sqrt{T} vec\left(\sum_t x_t u_t' \right) +$$

$$\left(I_N \otimes \widehat{\beta} \right) \sqrt{T} A \left(vec\left(\frac{1}{T} \sum_t \varepsilon_t \varepsilon_t' \right) - vec\left(\Omega \right) \right).$$

The limiting distribution follows from this immediately.

References

[1] Adler, M., B. Dumas, 1983, International portfolio choice and corporation finance: A synthesis, Journal of Finance 38, 925-984.

[2] Baele, L., K. Inghelbrecht, 2005, Structural versus temporary drivers of country and industry risk, *Journal of Empirical Finance*, Forthcoming.

[3] Basak, G., R. Jagannathan, G. Sun, 2002, A direct test for the mean variance efficiency of a portfolio, Journal of Economic Dynamics and Control 26, 1195-1215.

[4] Beckers, S., R. Grinold, A. Rudd, D. Stefek, 1992, The relative importance of common factors across the European equity markets, Journal of Banking and Finance 16, 75-95.

[5] Bekaert, G., C.R. Harvey, 1995, Time-varying world market integration, Journal of Finance 50, 403-444.

[6] Bekaert, G., R.J. Hodrick, X. Zhang, 2008, International Stock Return Comovements, *Journal of Finance,* Forthcoming.

[7] Brooks, R., M. del Negro, 2005, A latent factor model with global, country and industry shocks for international stock returns, IMF working paper wp/05/52.

[8] Burnside, A.C., M. Eichenbaum, S.T. Rebelo, 2007, The returns to currency speculation in emerging markets, American Economic Review Papers and Proceedings 97(2), 333-338.

[9] Campa, J.M., N. Fernandes, 2006, Sources of gains from international portfolio diversification, Journal of Empirical Finance 13, 417-443.

[10] Campbell, J.Y., K. Serfaty-de Medeiros, L. Viciera, 2008, Global Currency hedging, Journal of Finance, Forthcoming.

[11] Carrieri, F., V. Errunza, K. Hogan, 2007, Characterizing world market integration through time, Journal of Financial and Quantitative Analysis 42, 915-940.

[12] Catão, L., A. Timmermann, 2007, Volatility regimes and global equity returns, Forthcoming in T. Bollerslev, J. Russell, and M. Watson, (eds.), Volatility and Time Series Econometrics: Essays in Honour of Robert F. Engle, Oxford University Press.

[13] Cavaglia, S., C. Brightman, M. Aked, 2000, The increasing importance of industry factors, Financial Analyst Journal 56, 41-54.

[14] Chang, J., V. Errunza, K. Hogan, M. Hung, 2005, An international asset pricing model: Theory and empirical evidence, European Financial Management 11, 173-194.

[15] Dahlquist, M., T. Sällström, 2002, An evaluation of international asset pricing models, CEPR Discussion paper No. 3145.

[16] De Jong, F.A. de Roon, 2005, Time-varying market integration and expected returns in emerging markets, Journal of Financial Economics 78, 583-613.

[17] De Roon, F.A., T.E. Nijman, B.J.M. Werker, 2001, Testing for mean-variance spanning with short sales constraints and transaction costs: The case of emerging markets, Journal of Finance 56, 723-744.

[18] De Santis, G., B. Gerard, 1997, International asset pricing and portfolio diversification with time-varying risk, Journal of Finance 52, 1881-1912.

[19] ———, 1998, How big is the premium for currency risk? Journal of Financial Economics 49, 375-412.

[20] De Santis, G., B. Gerard, P. Hillion, 2003, The relevance of currency risk in the EMU, Journal of Economics and Business 55, 427-462.

[21] Drummen, M., H. Zimmerman, 1992, The structure of European stock returns, Financial Analyst Journal 48, 15-26.

[22] Dumas, B., B. Solnik, 1995, The world price of foreign exchange risk, Journal of Finance 50, 445-479.

[23] Ehling, P., S.B. Ramos, 2006, Geographic versus industry diversification: constraints matter, Journal of Empirical Finance 13, 396-416.

[24] Elton, E.J., M.J. Gruber, 1992, International diversification, in Summer N. Levine, ed.: Global Investing (Harper Business, New York, NY).

[25] Ferreira, M., P. Gama, 2005, Have World, Country and Industry Risk Changed Over Time? An Investigation of the Developed Stock Markets Volatility, Journal of Financial and Quantitative Analysis 40, 195-222.

[26] Ferson, W.E., A.F. Siegel, 2009, Testing portfolio efficiency with conditioning information, Review of Financial Studies 22, 2735-2758.

[27] Gibbons, M.R., 1982, Multivariate tests of financial models, Journal of Financial Economics 10, 3-27.

[28] Gibbons, M.R., S.A. Ross, J. Shanken, 1989, A test of the efficiency of a given portfolio, Econometrica 57, 1121-1152.

[29] Griffin, J.M.. A. Karolyi, 1998, Another look at the role of the industrial structure of markets for international diversification strategies, Journal of Financial Economics 50, 351-373.

[30] Grinold, R., A. Rudd, D. Stefek, 1989, Global factors: Fact or fiction? Journal of Portfolio Management 16, 79-88.

[31] Hansen, L.P., S.F. Richard, 1987, The role of conditioning information in deducing testable restrictions implied by dynamic asset pricing models, Econometrica 55, 587-613.

[32] Hardouvelis, G.A., D. Malliaropulos, R. Priestley, 2007, The impact of EMU on the equity cost of capital, Journal of International Money and Finance 26, 305-327.

[33] Heston, S.L., K.G. Rouwenhorst, 1994, Does industrial structure explain the benefits of international diversification?, Journal of Financial Economics 36, 3-27.

[34] Huberman, G., S. Kandel, 1987, Mean-variance spanning, Journal of Finance 42, 873-888.

[35] Isakov, D., F. Sonney, 2004, Are practitioners right? On the relative importance of industrial factors in international stock returns, Swiss Journal of Economics and Statistics 140.

[36] Jagannathan, R., T. Ma, 2003, Risk reduction in large portfolios: Why imposing the wrong constraints helps, Journal of Finance 58, 1651-1684.

[37] Jobson, J.D., B. Korkie, 1982, Potential performance and tests of portfolio efficiency, Journal of Financial Economics 10, 433-466.

[38] Lessard, D.R., 1974, World, national and industry factors in equity returns, Journal of Finance 29, 379-91.

[39] Lustig, H. N, A. Verdelhan, 2007, The cross-section of foreign currency risk premia and consumption growth risk, American Economic Review 97, 89-117.

[40] Magnus, J.R., H. Neudecker, 1988, Matrix differential calculus with applications in statistics and econometrics, John Wiley & Sons, Inc.

[41] Pukthuanthong-Le, K., R. Roll, 2008, Global market integration: An alternative measure and its application, Journal of Financial Economics, Forthcoming.

[42] Roll, R., 1992, Industrial structure and the comparative behavior of international stock market indices, Journal of Finance 47, 3-42.

[43] Sercu, P., 1980, A generalization of the international asset pricing model, Revue de l'Association Francaise de Finance 1, 91-135.

[44] Shanken, J., 1990, Intertemporal asset pricing: An empirical investigation, Journal of Econometrics 45, 99-120.

[45] Solnik, B., 1974a, An equilibrium model of the international capital market, Journal of Economic Theory 8, 500-524.

[46] Solnik, B., 1974b, Why not diversify internationally rather than domestically?, Financial Analysts Journal 30, 48-54, reprinted in Financial Analysts Journal 51, 1995, 89-94.

[47] Stambaugh, R.F., 1982, On the exclusion of assets from tests of the two-parameter model, Journal of Financial Economics 10, 235-268.

[48] Stehle, R., 1977, An empirical test of the alternative hypothesis of national and international pricing of risky assets, Journal of Finance 32, 493-502.

[49] Stulz, R.M., 1981, On the effects of barriers to international investment, Journal of Finance 36, 923-934.

[50] ———, 1995, International asset pricing: An integrative survey, Handbook of Modern Finance, R. Jarrow, M. Maksimovic and W. Ziemba eds., North Holland - Elsevier, 201-223.

[51] Vassalou, M., 2000, Exchange rate and foreign inflation risk premiums in global equity returns, Journal of International Money and Finance 19, 433-470.

[52] Zhang, X., 2006, Specification tests of international asset pricing models, Journal of International Money and Finance 25, 275-307.

Figure 1: 60-month moving window correlations and mean currency returns

Panel A displays the average correlation between the returns on the country and industry indices and the returns on the currency deposits. The dashed line represents the average correlation between country returns and currencies and the solid line reports the average correlation between industry returns and currencies. We consider returns on three currency deposits: the British Pound, the Japanese Yen and the spliced series of the German Mark (before 1999) and the Euro (after 1999). For each 60-month moving window the average is computed over all countries (industries) and currencies. Panel B reports the average return on the three currency deposits over 60-month moving windows.

Panel A: 60-month moving window average correlations between equities and currencies
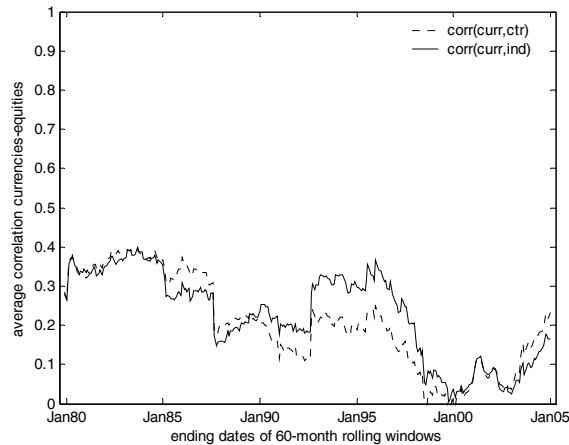
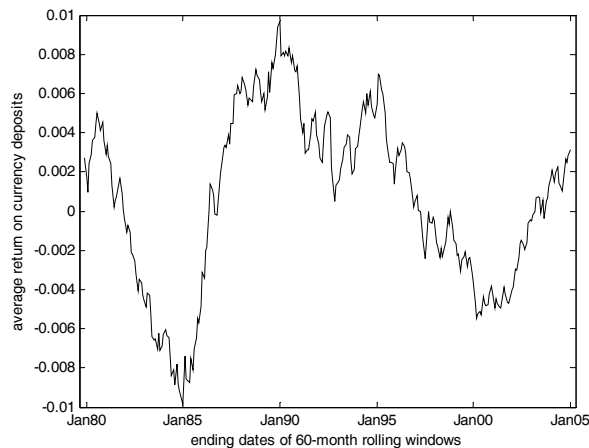Panel B: 60-month moving window average returns on currency deposits

Table 1: Summary statistics of country, global industry and currency returns

The table contains summary statistics for monthly returns on country and industry indices and the currency deposit (excess) returns from Datastream. Our sample period runs from February 1975 to February 2005 (361 observations). Returns are calculated in US dollars. Mean returns and standard deviations are in percentages. 'c(ctr)', 'c(ind)', 'c(cur)' give the average correlation of each index with the seven country indices, the ten industry indices, and the currency deposits respectively. The correlation of each index with itself is excluded. The correlation of the countries and industries with the currency deposits is based on Canadian Dollar, Yen, Pound Sterling and the spliced series of German Mark up to Jan 99 and Euro thereafter. The summary statistics of the French Franc, German Mark and Italian Lire are based on the period up to January 1999 and those of the Euro are based on the period starting in January 1999. 'min' and 'max' are the minimum and maximum returns (in percentages) respectively. 'weight' is the average weight (in percentages) of the index in the G7 world index over the sample period. The rows 'average' give the average over all country or industry summary statistics. Values in brackets are p-values associated with Wald test statistics for the null-hypotheses that all mean returns are equal or zero. The ten industries are: Resources (Res), Basic Industries (BasI), General Industries (GenI), Cyclical Consumer Goods (CCGd), Non-Cyclical Consumer Goods (NCGd), Cyclical Services (CS), Non-Cyclical Services (NCS), Utilities (UT), Information Technology (IT), and Financials (Fin).

Panel A: Country returns								
	mean (%)	stdv (%)	c(ctr)	c(ind)	c(cur)	min (%)	max (%)	weight (%)
Canada	1.03	5.08	0.470	0.524	0.194	-23.35	16.16	2.88
France	1.36	6.41	0.516	0.501	0.282	-25.71	19.69	3.01
Germany	1.04	5.64	0.477	0.482	0.307	-18.26	20.07	4.56
Italy	1.18	7.43	0.399	0.370	0.175	-22.57	28.26	1.67
Japan	1.05	6.67	0.533	0.606	0.326	-22.80	25.11	27.69
UK	1.40	5.72	0.499	0.557	0.305	-21.51	26.80	9.61
US	1.15	4.17	0.486	0.637	0.071	-21.18	14.50	50.58
average	1.17	5.88	0.457	0.525	0.237	-21.91	21.51	
World (G7)	1.07	4.14	0.663	0.792	0.287	-11.90	14.21	
H_0: All country means are zero								(0.000)
H_0: All country means are equal								(0.831)

36

Panel B: Global industry returns								
	mean (%)	stdv (%)	c(ctr)	c(ind)	c(cur)	min (%)	max (%)	weight (%)
Res	1.27	5.05	0.449	0.452	0.193	-18.16	18.27	8.26
BasI	0.99	5.03	0.584	0.686	0.315	-15.07	15.10	9.24
GenI	1.11	4.62	0.626	0.711	0.222	-18.13	16.88	10.36
CCGd	1.01	4.88	0.560	0.656	0.199	-17.16	15.65	6.16
NCGd	1.21	3.91	0.504	0.585	0.224	-15.34	14.40	13.69
CS	1.05	4.59	0.616	0.719	0.244	-13.67	15.08	12.29
NCS	0.96	4.58	0.480	0.541	0.193	-15.78	16.41	7.35
UT	1.11	4.18	0.355	0.449	0.306	-14.26	23.62	5.73
IT	1.16	6.75	0.524	0.537	0.125	-25.88	23.37	8.88
Fin	1.22	5.31	0.555	0.660	0.300	-16.28	25.34	18.04
average	1.11	4.89	0.525	0.600	0.232	-16.97	18.41	
H_0: All industry means are zero								(0.000)
H_0: All industry means are equal								(0.866)
H_0: All country and industry means are equal								(0.939)

Panel C: Currency returns							
	mean (%)	stdv (%)	c(ctr)	c(ind)	c(cur)	min (%)	max (%)
Canadian $	0.03	1.53	0.285	0.261	0.194	-5.78	4.11
French Franc	0.12	3.23	0.210	0.191	0.630	-9.24	8.55
German Mark	0.01	3.33	0.192	0.180	0.626	-10.09	8.51
Italian Lira	0.11	3.18	0.210	0.168	0.571	-13.57	9.00
Japanese Yen	0.11	3.59	0.258	0.314	0.376	-9.75	17.64
Pound Sterling	0.20	3.11	0.220	0.193	0.440	-12.62	14.41
Euro	0.19	2.93	0.182	0.099	0.205	-5.22	7.38

Table 2: Unconditional spanning tests

This table presents the unconditional spanning tests. Panel A reports performance tests of the industries relative to the seven countries (first three columns) and of the countries relative to the ten industries (last three columns). $a(\%)$ gives the Jensen measure as a percentage per month and is estimated from the regressions

$$r_t^y = a_y + B_y r_t^x + \varepsilon_t^y \text{ and } r_t^x = a_x + B_x r_t^y + \varepsilon_t^x$$

where r_t^y and r_t^x are excess returns on industry and country indices. The table gives estimates of a (in percentages) as well as the associated t-values. Panels B and C report p-values of tests for the joint significance of a set of Jensen measures. These are Wald tests for the hypotheses that the sets of assets listed in the column headers span the sets of assets listed in the first column. 'Currencies' are returns on three currency deposits: the spliced series of Deutschemark (until January 1999) and the Euro (as of January 1999), the Japanese Yen and the Pound Sterling. The ICAPM portfolio consists of the value-weighted G7 index plus the three currency deposits. While in Panel B the test and benchmark assets can have components in common, in Panel C the overlapping country and industry components have been removed from the benchmark assets. For instance, when the ICAPM portfolios are the benchmark assets, the world index excludes the country or industry of interest.

Panel A: Individual Jensen measures					
Ind. test assets, Ctr. benchmark assets			Ctr. test assets, Ind. benchmark assets		
	$a(\%)$	t-value		$a(\%)$	t-value
Res	0.19	(0.97)	Canada	-0.04	(-0.20)
BasI	-0.17	(-1.30)	France	0.21	(0.79)
GenI	-0.04	(-0.45)	Germany	0.00	(0.01)
CCGd	-0.09	(-0.64)	Italy	0.21	(0.60)
NCGd	0.14	(1.16)	Japan	0.00	(0.02)
CS	-0.15	(-1.53)	UK	0.21	(1.06)
NCS	-0.07	(-0.41)	US	0.00	(-0.04)
UT	0.27	(1.44)			
IT	-0.15	(-0.69)			
Fin	0.07	(0.52)			

Panel B: Spanning test p-values				
	Benchmark portfolios are based on:			
Test assets:	Countries	Industries	World	ICAPM
Countries	n.a.	(0.948)	(0.445)	(0.505)
Industries	(0.596)	n.a.	(0.086)	(0.090)
ICAPM	(0.559)	(0.133)	n.a.	n.a.
Currencies	(0.905)	(0.726)	(0.705)	n.a.

Panel C: Spanning tests excl. overlapping components				
	Benchmark portfolios are based on:			
Test assets:	Countries	Industries	World	ICAPM
Countries	n.a.	(0.427)	(0.097)	(0.198)
Industries	(0.401)	n.a.	(0.018)	(0.026)

Table 3: Unconditional Sharpe ratio tests

The table presents the results of the tests for differences in unconditional Sharpe ratios. Panel A reports the annualized Sharpe ratios for country, industry and world portfolios. Furthermore, three currency deposits are added to each of these portfolios. The ICAPM portfolios consist of the world portfolio, i.e. the value-weighted G7 index and the three currency deposits (German Mark - Euro, Japanese Yen and Pound Sterling). The first panel reports the maximum Sharpe ratios (annualized) achievable from each set of assets, without restrictions on short selling and with short sales restrictions ("nss"), and in parentheses the p-values associated with a Wald test for the hypothesis of zero loss of efficiency due to the short sales restrictions. This hypothesis is tested by examining the difference in maximum Sharpe ratios with and without short sales constraints. Panel B reports the p-values of the Sharpe ratio tests between the different portfolios when short position are allowed. Panel C shows the p-values when short sales are prohibited. The currency deposits are not subject to short sales constraints.

Panel A: Unconditional Sharpe ratios						
	Countries	Industries	Ctr + curr	Ind + curr	World	ICAPM
Sharpe p.a.	0.605	0.762	0.621	0.793	0.435	0.485
Sharpe (nss) p.a.	0.582	0.657	0.601	0.697	0.435	0.485
Eff. loss nss	(0.654)	(0.299)	(0.676)	(0.312)		

Panel B: Test of difference of unrestricted Sharpe ratios				
	Countries	Industries	Ctr + curr	Ind + curr
Countries vs	n.a.			
Industries vs	(0.334)	n.a.		
Ctr + currencies vs	n.a.	(0.399)	n.a.	
Ind + currencies vs	(0.254)	n.a.	(0.278)	n.a.
world vs	(0.187)	(0.078)	(0.166)	(0.062)
ICAPM vs	(0.341)	(0.139)	(0.207)	(0.082)

Panel C: Test of difference of Sharpe ratios with short sales constraints				
	Countries	Industries	Ctr + curr	Ind + curr
Countries vs	n.a.			
Industries vs	(0.526)	n.a.		
Ctr + currencies vs	n.a.	(0.667)	n.a.	
Ind + currencies vs	(0.366)	n.a.	(0.416)	n.a.
world vs	(0.209)	(0.084)	(0.188)	(0.075)
ICAPM vs	(0.413)	(0.221)	(0.227)	(0.090)

Table 4: Unconditional efficiency tests: sub samples

The table reports the results of the unconditional efficiency tests for three ten-year sub samples: from February 1975 to January 1985, from February 1985 to January 1995 and from February 1995 to February 2005, based on passive portfolio strategies. Panel A presents the p-values of the usual spanning tests in which some test assets and benchmark assets have primitive assets in common. Panel B presents the unconditional Sharpe ratios (annualized) with and without short sales constraints (restrictions on short selling are denoted by "nss"). The currency deposits are not subject to short sales constraints. The panel also reports the p-values of the test for efficiency loss due to the short sales constraints.

Panel A: Unconditional spanning test p-values				
	Benchmark assets			
	Countries	Industries	World	ICAPM
Sub sample 1: 1975-1985				
Test assets Countries	n.a.	(0.407)	(0.104)	(0.094)
Industries	(0.205)	n.a.	(0.193)	(0.071)
ICAPM	(0.004)	(0.014)	n.a.	n.a.
Currencies	(0.062)	(0.059)	(0.096)	n.a.
Sub sample 2: 1985-1995				
Test assets Countries	n.a.	(0.314)	(0.045)	(0.020)
Industries	(0.377)	n.a.	(0.004)	(0.001)
ICAPM	(0.004)	(0.000)	n.a.	n.a.
Currencies	(0.199)	(0.187)	(0.360)	n.a.
Sub sample 3: 1995-2005				
Test assets Countries	n.a.	(0.438)	(0.018)	(0.058)
Industries	(0.904)	n.a.	(0.192)	(0.214)
ICAPM	(0.020)	(0.010)	n.a.	n.a.
Currencies	(0.175)	(0.087)	(0.112)	n.a.

Panel B: Unconditional Sharpe ratios						
	Countries	Industries	Ctr + curr	Ind + curr	World	ICAPM
Sub sample 1: 1975-1985						
Sharpe p.a.	0.702	0.988	1.166	1.370	0.375	0.912
Sharpe (nss) p.a.	0.517	0.578	1.149	1.119	0.375	0.912
Eff. Loss nss	(0.470)	(0.213)	(0.746)	(0.190)		
Sub sample 2: 1985-1995						
Sharpe p.a.	0.936	0.999	1.197	1.246	0.545	0.824
Sharpe (nss) p.a.	0.800	0.818	1.068	1.017	0.545	0.824
Eff. Loss nss	(0.456)	(0.385)	(0.407)	(0.259)		
Sub sample 3: 1995-2005						
Sharpe p.a.	1.053	1.002	1.259	1.276	0.371	0.835
Sharpe (nss) p.a.	0.677	0.782	1.031	1.101	0.371	0.835
Eff. Loss nss	(0.175)	(0.325)	(0.254)	(0.349)		

Table 5: Conditional spanning tests

This table presents the results of the conditional spanning tests. The null hypothesis that managed country portfolios span managed industry portfolio is based on the regression

$$r_t^{man,y} = a_y + D_y r_t^{man,x} + \varepsilon_t^y,$$

where $r_t^{man,y}$ and $r_t^{man,x}$ are excess returns on managed industry and country portfolios. The regressions for other sets of test and benchmark assets are similar. The instruments used for the countries, industries and world portfolio are a constant (i.e., the returns on the indices themselves are included), the short term US interest rate, the US term spread, the US default spread, and the spread between the dividend yield on the world portfolio and the US short term interest rate. The instruments for the currency deposits are a constant, the short term US interest rate, and the spreads between the UK and US interest rate, the Japanese and US interest rate, and the German and US interest rate. The first panel reports the p-values associated with a Wald test for the hypothesis that the sets of assets listed in the column headers span the sets of assets listed in the first column. Panel B provides p-values of the spanning tests when the benchmark portfolios exclude the country or industry of interest.

Panel A : Spanning tests p-values				
	Benchmark portfolios are based on:			
Test assets:	Countries	Industries	World	ICAPM
Countries	n.a.	(0.655)	(0.404)	(0.758)
Industries	(0.009)	n.a.	(0.001)	(0.012)
ICAPM	(0.001)	(0.000)	n.a.	n.a.
Currencies	(0.000)	(0.000)	(0.000)	n.a.

Panel B: Spanning tests excl. overlapping components				
	Benchmark portfolios are based on:			
Test assets:	Countries	Industries	World	ICAPM
Countries	n.a.	(0.445)	(0.203)	(0.516)
Industries	(0.008)	n.a.	(0.001)	(0.016)

Table 6: Conditional Sharpe ratio tests

The table presents the results of the tests for differences in conditional Sharpe ratios for dynamic country, industry and ICAPM (i.e. world plus currency deposits) portfolios. Furthermore, three currency deposits are added to the country and industry portfolios. The instruments used for the countries, industries and world portfolio are a constant, the short term US interest rate, the US term spread, the US default spread, and the spread between the dividend yield on the world portfolio and the US short term interest rate. The instruments for the currency deposits are a constant, the short term US interest rate, and the spreads between the UK and US interest rate, the Japanese and US interest rate, and the German and US interest rate. The first panel reports the maximum Sharpe ratios (annualized) achievable from each set of assets, without and with short sales (nss) restrictions, and the p-values (in parentheses) associated with a Wald test for the hypothesis of zero loss of efficiency due to the short sales restrictions. Panel B reports the p-values of the Sharpe ratio tests between the different portfolios when short position are allowed. Panel C shows the p-values when short sales are prohibited. The currency deposits are not subject to short sales constraints.

Panel A: Conditional Sharpe ratios						
	Countries	Industries	Ctr + curr	Ind + curr	World	ICAPM
Sharpe p.a.	1.197	1.780	1.744	2.246	0.643	1.462
Sharpe (nss) p.a.	0.704	0.797	1.513	1.554	0.643	1.462
Eff. loss nss	(0.006)	(0.000)	(0.022)	(0.000)		

Panel B: Test of difference of unrestricted Sharpe ratios				
	Countries	Industries	Ctr + curr	Ind + curr
Countries vs	n.a.			
Industries vs	(0.008)	n.a.		
Ctr + currencies vs	n.a.	(0.877)	n.a.	
Ind + currencies vs	(0.000)	n.a.	(0.008)	n.a.
World vs	(0.004)	(0.000)	(0.000)	(0.000)
ICAPM vs	(0.231)	(0.193)	(0.014)	(0.000)

Panel C: Test of difference of Sharpe ratios with short sales constraints				
	Countries	Industries	Ctr + curr	Ind + curr
Countries vs	n.a.			
Industries vs	(0.421)	n.a.		
Ctr + currencies vs	n.a.	(0.002)	n.a.	
Ind + currencies vs	(0.000)	n.a.	(0.539)	n.a.
World vs	(0.652)	(0.283)	(0.000)	(0.000)
ICAPM vs	(0.003)	(0.006)	(0.456)	(0.244)